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# A NEW *SOMATOGYRUS* FROM THE SOUTHWESTERN OZARKS WITH A BRIEF REVIEW OF THE HYDROBIIDAE FROM THE INTERIOR HIGHLANDS (GASTROPODA: PROSOBRANCHIA)

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ABSTRACT

*A previously unknown* Somatogyrus *is described from the Elk River, McDonald County, Missouri. With this description, the number of Hydrobiidae presently recorded from the Interior Highlands increases to 15, including 11 regional endemics. Nine species are endemic to the Ozark Plateaus, while two* Somatogyrus *are restricted to the Ouachita Mountains. Five of the Ozark endemics are obligate troglobites. Troglobitic* Amnicola antroecetes *(Hubricht) is considered distinct from epigean* A. aldrichi *(Call and Beecher).*

Excepting the Unionoidea, little study has been afforded the aquatic Mollusca of the Interior Highlands. Among the poorer known groups, regional accounts of the Hydrobiidae are rare. The primary sources of published records have been original descriptions of several endemic species (e.g. Walker, 1915; Hinkley, 1915; Hubricht, 1979), although the occasional collection of hydrobiids has been noted in a few species surveys (e.g. Sampson, 1913; Wheeler, 1918; Gordon, 1981). A recent faunal survey of drainage basins in southwestern Missouri and northwestern Arkansas (Gordon, 1980) recovered several species of Hydrobiidae. A previously unknown *Somatogyrus*, collected from the Elk River, McDonald County, Missouri, is here described.

Family Hydrobiidae Troschel 1857
Subfamily Lithoglyphinae Fischer 1885
***Somatogyrus rosewateri*** *new species*

*Shell description of holotype*–Shell subglobose, medium size for *Somatogyrus*, solid, dextral, 4.25 whorls, turbinate, subhyaline; body whorl .90 times axial height, greatly inflated; penultimate whorl .34 times width of body whorl (Fig. 1; see Table 1 for holotype measurements and range of paratypes). Spire very short, depressed, broadly conic; sutures moderately impressed; protoconch flattened (Fig. 2). Periostracum greenish (may be masked by color of visceral mass showing through shell) with shallow, oblique growth striae; protoconch ornamented with fine, spiral ridges (Fig. 3). Aperture broadly ovate, .74 times axial height, .80 times height and .55 times width of body whorl, plane of aperture at 30° to shell axis. Peristome complete across parietal wall by a callus which continues and thickens across columella (callus in some individuals may be slightly reflected over columella, partially obscuring umbilicus); lip straight along parietal wall, curving concavely near the umbilicus and along columella, parietal-columellar junction non-angular. In lateral view (Fig. 4), periphery of parietal lip


FIGS. 1-5. *Somatogyrus rosewateri* n. sp. **1**, apertural view of paratype (3.9 × 3.8 mm.); **2**, juvenile paratype; **3**, suture and protoconch sculpture of paratype. The barely visible white bar in the upper left is 10 microns in length. **4**, lateral view of paratype (4.2 × 3.8 mm.); **5**, umbilical view of paratype (shell, 3.6 × 3.5 mm.).

approximately parallel to plane of aperture, columella straight but recedes towards base, and parietal-columellar junction forms an obtuse angle. Umbilicus relatively open for *Somatogyrus* (Fig. 5); passes into a shallow, canal-like depression continguous to the columellar lip. Basal lip slightly receded due to angle of aperture; area of base-columellar junction projects forward about equal to the distance of the basal lip recession (Fig. 4).

Operculum chitinous, ovate, horn-colored; paucispiral, consisting of about three whorls; nucleus subcentral, located slightly left of midline in lower third; outer surface sculptured with many fine growth striae, peripheral margin without striae and edge appears slightly ragged (Fig. 6).

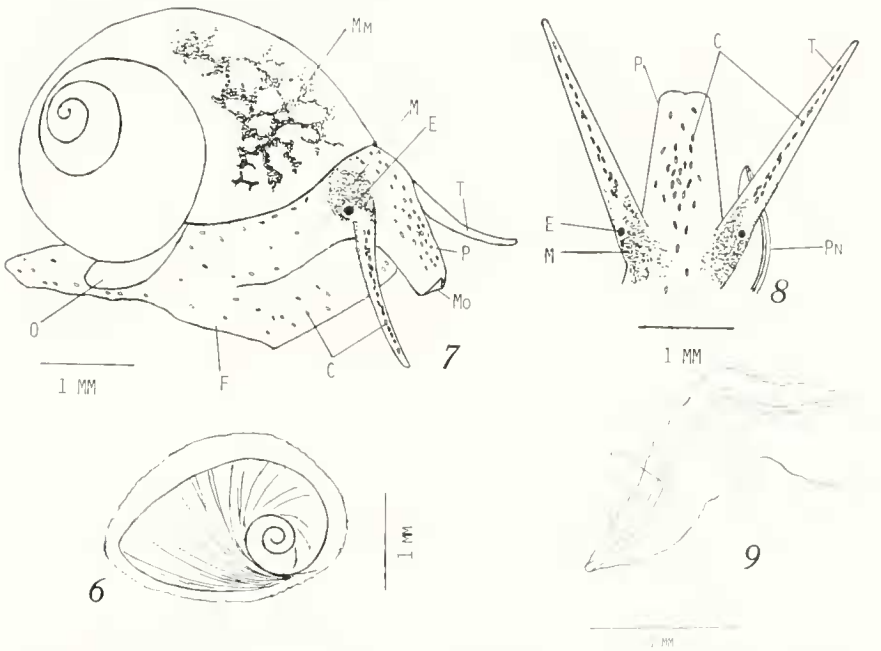
*Soft parts*—Living animals translucent (odontophore complex visible through proboscis), whitish. Mantle collar and dorsal aspects of proboscis, head, tentacles, and foot speckled with sub-epidermal gold to orangish gold chromatocytes (Fig. 7); dorsal surface and ⅓ thickness of visceral mass infused with golden color. Dense concentrations of melanin at base of tentacles, extends dorso-medially in front of eyes a short distance and posteriorly on to dorsum of head (Fig. 8); a narrow line of melanin runs laterally from in front of eye forward about ¼ to ⅓ length of tentacle; dorsal and lateral surfaces of mantle with mottled patterns of melanin (Fig. 7), 35% of paratypes (n=52) lacked mantle melanin. Shells of living snails appear amber to orangish due to visceral and mantle pigmentation showing through shell, darkens to brown in spire; melanistic snails have slightly browner tint. Penis unpigmented. Preserved animal white.

Foot broad (Fig. 7); anterior truncated, extending forward to eyes; posterior tapers to a rounded point. Head (Fig. 8) extends anterior of shell to expose eyes; proboscis relatively long and slender, curved ventrally; tentacles long and slender, eyes positioned ventro-laterally at base. Penis (Fig. 9) slender, simple; tapers to a fine, blunt point; dorso-ventrally flattened, dorsum slightly convex, venter flatly concave; vas deferens positioned near posterior margin. Penis arises a short distance inside mantle cavity above and behind the right tentacle, tends to curve counter clockwise; when extruded, emerges from shell directly behind right tentacle and extends below it (Fig. 8).

*Type locality*—Missouri, McDonald County, Elk River at Missouri Department of Conservation Mt. Shira Public Fishing Access, 1.6 km south of Ginger Blue (R33W, T21N, sections 1 and 2). Holotype: University of Colorado Museum of Zoology (UCM) no. 32812; collected 24 October 1985 by Mark E. Gordon. Allotype: UCM no. 32813; same data as holotype. Paratypes: ten specimens each deposited at UCM, U.S. National Museum of Natural History, Academy of Natural Sciences of Philadelphia,

TABLE 1. Dimensions of holotype, allotype, and paratypes of *Somatogyrus roseuateri* (measurements in mm): H = height, W = width, BH = body whorl height, PW = penultimate whorl width, A = aperture, AH = aperture height, AW = aperture width.

| | H | W | W/H | BH | BH/H | W/BH | PW | PW/W | AH | AW | AW/AH | Plane of A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Holotype (♀) | 3.9 | 3.8 | .97 | 3.5 | .90 | 1.09 | 1.3 | .34 | 2.8 | 2.1 | .75 | 30° |
| Allotype (♂) | 3.4 | 3.4 | 1.00 | 3.1 | .91 | 1.10 | 1.0 | .29 | 2.5 | 1.9 | .76 | --- |
| Paratype | 3.7 | 3.6 | .97 | 3.2 | .86 | 1.13 | 1.2 | .33 | 2.3 | 2.1 | .91 | --- |
| "" | 4.0 | 3.7 | .93 | 3.5 | .88 | 1.06 | 1.2 | .32 | 2.7 | 1.7 | .63 | 34° |
| "" | 4.1 | 3.9 | .95 | 3.6 | .88 | 1.08 | 1.2 | .31 | 2.8 | 2.4 | .86 | 29° |
| "" | 4.0 | 3.8 | .95 | 3.6 | .90 | 1.06 | 1.1 | .29 | 2.9 | 2.2 | .76 | --- |
| "" | 3.9 | 3.7 | .95 | 3.4 | .87 | 1.09 | 1.2 | .32 | 2.5 | 2.1 | .84 | 34° |
| "" | 3.8 | 3.8 | 1.00 | 3.4 | .89 | 1.12 | 1.3 | .34 | 2.4 | 2.1 | .88 | 35° |
| "" | 3.8 | 3.5 | .92 | 3.4 | .89 | 1.03 | 1.3 | .37 | 2.5 | 2.1 | .84 | 30° |
| (Fig. 1) | 3.9 | 3.8 | .97 | 3.5 | .90 | 1.09 | 1.1 | .29 | 2.5 | 2.1 | .84 | 30° |
| (Fig. 3,4) | 4.2 | 3.8 | .90 | 3.7 | .88 | 1.03 | 1.3 | .34 | 2.8 | 2.2 | .79 | 30° |
| (Fig. 5) | 3.6 | 3.5 | .97 | 3.3 | .92 | 1.06 | 1.0 | .29 | 2.5 | 1.9 | .76 | 27° |




FIGS. 6-9. *Somatogyrus roseuateri* n. sp. **6**, opereulum; **7**, animal extruded from shell (composite drawing from live and relaxed specimens; body slightly distended from relaxation with sodium pentobarbital): C = chromatocytes, E = eye, F = foot, M = melanin, Mm = mantle melanin showing through shell, Mo = mouth, O = operculum, P = proboscis, T = tentacle; **8**, dorsal view of head: Pn = penis; **9**, penis: V = vas deferens.

Museum of Comparative Zoology, University of Michigan Museum of Zoology, and Field Museum; same data as holotype.

*Distribution*—Found only in the middle section of Elk River (Fig. 10). To date, this species has been collected from only the type locality and below an old mill dam at Noel, McDonald County, Missouri. It was not recovered from


FIG. 10. Distribution of *Somatogyrus roscwateri* (solid triangle is the type locality).

areas upstream of the type locality nor the river channel downstream from the Missouri-Oklahoma border which has been inundated by a reservoir on the Neosho River (Grand Lake O' the Cherokees). The known range of this species occurs in the Springfield Plateau region of the Ozarks.

*Habitat*—Specimens were collected at the type locality from a series of riffles. Substrate was composed of gravel and cobble-sized materials (mainly chert). At Noel, habitat was below the outfall of a small mill dam. Substrates were primarily stepped and broken bedrock with some cobble. Gradients at both sites were fairly high and water quality was quite good (Table 2).

*Etymology*—This species is named in memory of Dr. Joseph Rosewater, late Curator of Mollusks, U.S. National Museum of Natural History.

## Discussion

The comparative difference between *S. roscwateri* and previously described species in the genus are shown in Table 3.

TABLE 2. Physico-chemical measurements made at type locality, Elk River; 20 November, 1979.

| | |
|---|---|
| Water temperature | 15 °C |
| Turbidity | 1.6 NTU |
| Specific conductance | 260 μmhos/cm |
| Alkalinity | 140 mg/l total $CaCO_3$ |
| pH | 8.15 |
| Nitrate | 1.5 mg/l |
| Color | negligible |

Besides *Somatogyrus roscwateri*, the only other hydrobioids collected from the Elk River basin were the nymphophiline *Cincinnatia integra* (Say) and the pomatiopsid *Pomatiopsis lapidaria* (Say) (Gordon, 1980). Two other *Somatogyrus* are known from the Ozark Plateaux. *Somatogyrus depressus* (Tryon), an inhabitant of the upper Mississippi River valley, occurs in the Osage River, central Missouri (Thompson, 1984) and *S. crassilabris* Walker, an Ozark endemic, is apparently known only from its original collection from the North Fork of the White River, Arkansas. In discussing phylogenetic relationships among North American Lithoglyphinae, Thompson (1984) noted difficulties in pursuing such studies due to a relatively large number of undescribed species and a paucity of morphological data for described species. For *Somatogyrus*, he did list several characters useful for specific comparisons. Available data for the three Ozark species and two Ouachita Mountains endemics (Table 3) suggests that the Ozark species may be fairly closely related. Walker (1915) also considered *S. wheeleri* Walker closer to *S. crassilabris* than to its Ouachitan congener. However, both Ouachita Mountains endemics may have evolved from other lineages (e.g. Alabama River). Considerably more information is necessary before such speculative, phylogenetic relationships may be confirmed. In some instances, complete analyses may no longer be possible. Many hydrobiids, such as *S. crassilabris*, *S. amnicoloides* Walker, and *S. wheeleri*, are known only from their type localities. Habitat alterations, such as reservoir construction, may have been deleterious for species with such highly restricted distributions.

Fifteen species of Hydrobiidae have been documented from the Interior Highlands (Table 4). Four are wide-ranging species. In the case of *Probythinella lacustris* (Baker) (mistakenly listed as *P. binneyana* (Hannibal) in Gordon, 1981) and *Somatogyrus depressus*, their southern distributional limits occur in the Ozarks. *Cincinnatia integra* and *Birgella subglobosa* (Say) have considerably larger ranges than the previous, more northerly distributed species (see Burch and Tottenham, 1980; Thompson, 1984). The remaining eleven species are endemic to the Interior Highlands. *Somatogyrus*

TABLE 3. Variation in shell morphology among Interior Highlands *Somatogyrus* (data adapted from Baker, 1928; Burch and Tottenham, 1980; Hinkley, 1915; Walker, 1915; and this study).

| | depressus | crassilabris | rosewateri | wheeleri | amnicoloides |
|---|---|---|---|---|---|
| Shell obesity (W/H) | .78-1.00 | .77-.92 | .90-1.00 | .93 | .78 |
| Size | | | | | |
| medium (< 4 mm)(0) | 0 | 0 | 0 | 0 | 1 |
| small (> 4 mm)(1) | | | | | |
| Spire | | | | | |
| depressed (>15% H)(0) | 0 | 0 | 0 | 1 | 1 |
| elevated (<15% H)(1) | | | | | |
| Protoconch | | | | | |
| flattened (0) | 0 | 0 | 0 | 1 | 0 |
| elevated (1) | | | | | |
| Parietal-columellar wall junction of lip | | | | | |
| smooth curve (0) | 0 | 0 | 0 | 0 | 1 |
| angular (1) | | | | | |
| Umbilicus | | | | | |
| narrow (0) | 0 | 0 | 1 | 1 | 0 |
| open (1) | | | | | |
| Widest expansion of outer lip periphery | | | | | |
| above mid-height (0) | 0 | 0 | 0 | 0 | 1 |
| below mid-height (1) | | | | | |
| Aperture apex relation to parietal wall | | | | | |
| fused (0) | 0 | 0 | 0 | 1 | 0 |
| detached (1) | | | | | |

*amnicoloides* and *S. wheeleri* are presently the only endemic hydrobiids that have been identified from the Ouachita Mountains province. Four epigean and five troglobitic species are endemic to the Ozark Plateaus. The majority (eight) are restricted to the eastern half of the province. The only endemic, western Ozark hydrobiid presently recognized is *S. rosewateri;* however, a single specimen of *Somatogyrus* has been collected from the headwaters area of the White River, Arkansas (Gordon, 1980). This specimen was too eroded to allow identification beyond genus and subsequent collecting failed to recover additional specimens.

Most of the Ozark endemic, obligate troglobitic Hydrobiidae have been referred to Amnicolinae: *Amnicola*. Burch and Tottenham (1980) noted that this classification was tentative due to the lack of anatomical data for these species. However, *Antrobia culveri* Hubricht was relegated to the Lithoglyphinae without justification by Burch and Tottenham (1980). The anatomy of this species remains all but unknown. The brief description of the radula presented by Hubricht (1971) does not appear to meet the radular criterion for Lithoglyphinae established by Thompson (1984) and differs from that of *Amnicola* only by the size of the central tooth mesocone. Hubricht (1971) described the penis of *Antrobia* as "simple, tapering to a point, without appendages." This morphology is characteristic of the lithoglyphine penis (Thompson, 1984) and is probably the basis for the classification in Burch and Tottenham (1980). Unfortunately, Hubricht (1971) did not describe the number of ducts penetrating the penis. Thompson (1984) considered the Amnicolinae, with two penial ducts, remote in

TABLE 4. Hydrobiidae known from the Interior Highlands.

Hydrobiinae
*Probythinella lacustris* (Baker, 1928)
Lithoglyphinae
*Somatogyrus amnicoloides* Walker, 1915
*Somatogyrus crassilabris* Walker, 1915
*Somatogyrus depressus* (Tryon, 1862)
*Somatogyrus roseovateri* new species
*Somatogyrus wheeleri* Walker, 1915
Nymphophilinae
*Birgella subglobosa* (Say, 1825)
*Cincinnatia integra* (Say, 1821)
*Marstonia ozarkensis* (Hinkley, 1915)[1]
Amnicolinae
*Amnicola aldrichi* (Call and Beecher, 1886)[2]
*Amnicola antroecetes* (Hubricht, 1940)[3]
*Amnicola corae* Hubricht, 1979[3]
*Amnicola prosperpina* Hubricht, 1940[3]
*Amnicola stygia* Hubricht, 1971[3]
*Antrobia culveri* Hubricht, 1971[3]

[1]*Pyrgulopsis ozarkensis* is placed in *Marstonia* following the suggestion of Thompson (1977).
[2]Burch and Tottenham (1980) included *Amnicola missouriensis* Pilsbry, 1898 as a valid species. Although this group requires further anatomical investigation, the argument of Hubricht (1940) for synonymizing this species under *A. aldrichi* is followed.
[3]Troglobitic.

relationships to the hydrobiid subfamilies possessing single-duct penes (e.g. Lithoglyphinae). Additionally, Thompson (1984) suggested that the simple, non-appendaged penis was a generalized, primitive condition in the Lithoglyphinae but may occur as a "derived condition through the secondary loss of previously existing characters" for some taxa in other hydrobiid subfamilies (e.g. Hershler and Davis, 1980: Hydrobiinae; Hershler, 1985: Littoridininae). Considering similarities of the antrobian radula, shell, and operculum to *Amnicola*, morphology of the penis may represent a secondarily derived character state in *Antrobia*. In conjunction with the above, a conservative classification would retain *A. culveri* in the Amnicolinae until phylogenetic relationships can be resolved.

The only endemic, epigean amnicoline presently recognized is *Amnicola aldrichi* (Call and Beecher), which exhibits a habitat preference for springs. Hubricht (1940) described three subspecies for *A. aldrichi: aldrichi* s.s., *insolita* Hubricht, and *antroecetes* Hubricht. "Deeper sutures, strongly shouldered whorls, and a free lip (Hubricht, 1940)" differentiated *insolita* from *aldrichi* s.s. Hubricht's illustration and description of a free lip indicate a slightly uncoiled body whorl. This condition occurs occasionally within the Gastropoda and has been shown to sometimes represent distinct, geographical subspecies (e.g. Clarke, 1973: *Valvata sincera ontariensis* Baker). Recently collected specimens (juveniles-adults) from one of Hubricht's *insolita* localities (2 November, 1985; Meramec Spring, 8 km southeast of St. James, Phelps County, Missouri) were examined and found to exhibit considerable variability with regards to the distinguishing characters for *insolita*. In no case was there any evidence of an uncoiled body whorl. Palmer (1985 and references within) demonstrated that shell variation in gastropods can be strongly influenced by environmental conditions and/or intraspecific genetic plasiticity and does not necessarily reflect divergence (i.e. speciation). The distribution of *insolita* (from Hubricht, 1940) is not geographically distinct from that of *aldrichi* s.s. Considering the above, *insolita* does not appear to warrant subspecific status in the modern sense (see Mayr, 1966).

Morton (1967) and many others have discussed problems related to constructing molluscan classifications from single-based systems (e.g. shell morphology). As noted above, variation in shell characters does not always imply speciation (Palmer, 1985). Conversely, lack of shell morphological variance is not always indicative of conspecificity or close phylogenetic relationships, but may mask divergent or convergent evolution (Davis, 1979; Dillon and Davis, 1980; Vail, 1980; Thompson, 1984). Hubricht (1940) was unable to readily differentiate shells of his third subspecies, *Amnicola aldrichi antroecetes*, from slender examples of *aldrichi* s.s. Both the previously discussed "subspecies" are epigean forms with pigmented bodies and functional eyes; however, *antroecetes* is an unpigmented, blind, obligate troglobite. Hubricht (1940) failed to be consistant in his methodology for distinguishing the subspecies of *A. aldrichi; insolita* by shell characters vs. *antroecetes* by anatomy and operculum. Even though *insolita* is considered invalid, this deviation still suggests that different levels of organization were being examined. Thompson

(1984) indicated that "a high degree of anatomical uniformity" exists within groups of the Hydrobiidae (e.g. Lithoglyphinae). The loss of pigmentation and eyes represents a rather radical divergence from the epigean anatomy of *aldrichi* s.s. To consider these troglobitic adaptations to be ecophenotypic variation implies an amazing genetic plasticity and an "use it or lose it" evolutionary interpretation. Ecophenotypic variation does not meet modern criteria for subspecific status (Mayr, 1966); however, previous relegation of *antroecetes* as a subspecies reflects the over-reliance on shell characters for constructing phylogenies. *Amnicola antroecetes* should be considered a distinct species. Interestingly, *A. antroecetes* has a rather wide distribution when compared to other regional troglobitic gastropods (restricted to single or connected caves). Other troglobitic taxa (e.g. Amblyopsidae; Isopoda: *Caecidotea*) exhibit similarly wide ranges in the Interior Highlands. This may be related to the karst geology of the region. Hubricht (1940) did note some size variation at different localities but correlated this to food availability. However, due to its wide range he suggested that *A. antroecetes* may represent a composite group. Further investigation is obviously warranted for the *A. aldrichi* complex and, for that matter, the Hydrobiidae throughout the Interior Highlands.

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